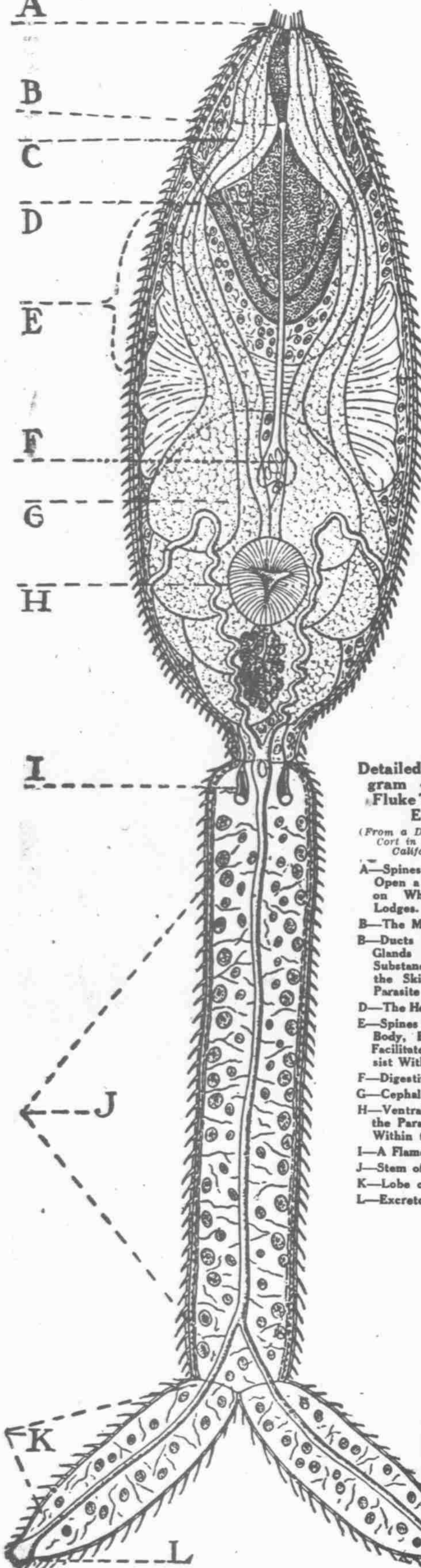


A Brand New Disease Arrives in America

**Japanese Laborers from the Rice Fields Spread Little Worms
Hitherto Unknown Here, Which Burrow Into the
Skin, Travel Along in the Blood to the Liver
Where They Settle
Down and Gnaw the
Liver Until You
Die**



Detailed Sectional Diagram of the Blood Fluke Tremendously Enlarged.

(From a Drawing by Professor Cort in the University of California Bulletin.)

- A—Spines That Cling to and Open a Way into the Skin on Which the Parasite Lodges.
- B—The Mouth.
- C—Ducts of the Cephalic Glands Which Secrete a Substance That Dissolves the Skin and Assists the Parasite to Penetrate.
- D—The Head Glands.
- E—Spines Covering the Whole Body, Bent Downward to Facilitate Entrance and Resist Withdrawal.
- F—Digestive System.
- G—Cephalic Glands.
- H—Ventral Sucker by Which the Parasite Attaches Itself Within the Liver.
- I—A Flame Cell.
- J—Stem of the Tail.
- K—Lobe of the Tail.
- L—Excretory Pore.



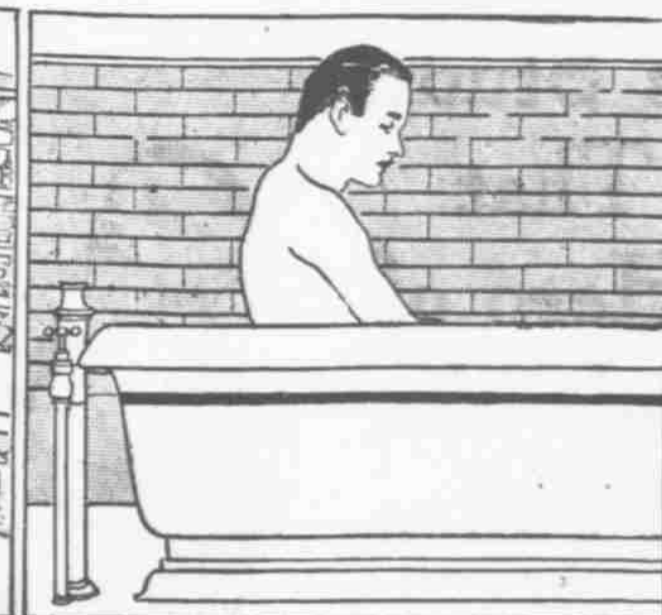
1—The Japanese Laborer, Working in the Rice Fields of His Own Land, Comes in Contact with the Little Blood Fluke Which Penetrates His Skin Enters Into His Blood.



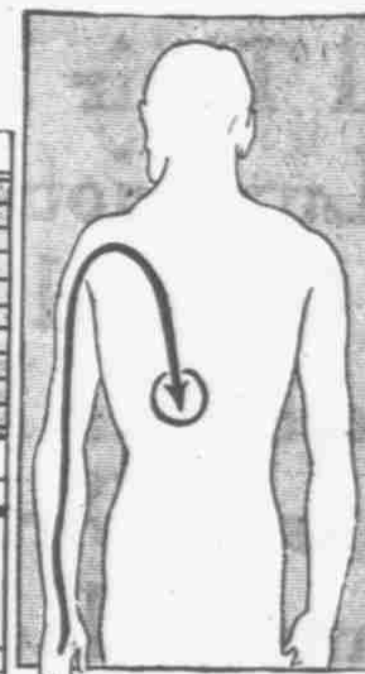
2—The Infected Japanese Laborer Comes to America to Work. The Disease Being Slow and Having No Outward Symptoms He Passes the Health Tests of the Government Inspectors.



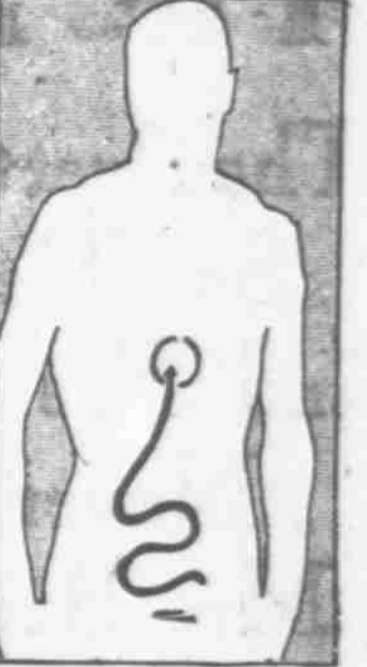
3—The Microscopic Parasites Flourish in the Bodies of Snails, Mice, Rats and Other Animals; in Grains of Rice, and Water Courses.



4—The Water Running from the Reservoirs Into Bathtubs and Other Receptacles May Carry with It Some of the Flukes, Which Are Thus Communicated to the Skin of the Bather, or Mice and Rats May Infect Food.



5—The Blood Fluke, by Means of Its Extraordinary Penetrating Apparatus, Enters the Blood Stream by Way of the Skin and Passes Down Through Veins and Arteries Until It Reaches the Liver, Where It Lodges.



6—The Female of the Fluke Crawls from the Liver to the Intestines to Deposit Her Eggs, the Hatchlings from Which Reinfect the Victim and Increase the Number of Their Kind in the Outer World.

By Dr. W. H. Ballou.

AMERICAN and Japanese morphologists have been intensely stirred by the discovery that a blood fluke, or parasitic disease of the liver, has developed in Japan, and has been introduced into this country by laborers brought over to cultivate rice fields. It has appeared as far inland from the western coast as Montana, and a closely allied form has shown itself in New Orleans.

The Japanese blood fluke is so called from its shape, which roughly resembles the fish of that name. It is in reality a microscopic worm with some very extraordinary habits. As far back as the crusades the Knights became acquainted with its cousins, always with fatal results for the Knights. After a time they died of what probably even then was known as "liver complaint."

For the blood fluke, or schistosoma japonicum, makes straight for the liver of whatever animal it enters, and there proceeds to eat heartily, to multiply exceedingly—with certain interesting exceptions to be discussed later—and to live luxuriously until its favorite food is, if not all gone, at least so reduced as to be of no use to its legitimate owner, who then quite naturally dies.

Regarding its foothold in this country Dr. William W. Cort, in a Bulletin of the Department of Zoology of the University of California, writes:

"Dr. A. C. Reed, in the State Medical Journal, announces discovery of five cases

of schistosomiasis—blood fluke disease—from California, and mentions others that came to his attention. His conclusions in regard to the dangers from this disease are similar to my own. Our studies on human schistosomes are of peculiar importance on account of the introduction here of the disease by immigration from countries where the disease is prevalent.

"Further, records of the United States Public Health Service and also case records show that schistosomiasis has found a foothold in this country. If suitable intermediate hosts for the little worms could be found this disease might become established, especially since it can develop in such carriers as humans, cats, dogs, rats, cattle and other animals. Trematodes, intestinal worms, of this type show considerable adaptability to varied animal hosts.

"The cercariae—young worms—freed from snails in the rice fields would be stirred into activity by the passing of any likely host to scramble on. Coming in contact with the human or other animal's skin, the young worms would catch hold with the under sucker, and by extension of body and the butting with spines of their forward end, would produce a slight opening.

"Aided by secretions of the glands, the backward pointing of spines and their movement, the young worms would rapidly take advantage of the opening to penetrate the skin of whatever animal it alighted on. In fact, the young of the species of the Japanese blood fluke introduced into America, schistosoma japonicum, is primarily a machine for skin penetration. Its structure is completely dominated by those adaptive larval characters which make possible its penetration of the human skin."

Not less alarmed by the discovery of the prevalence of the fluke disease in Asia, all of the available morphologists of Japan are at work, not only on intensive studies of the malady, but on measures for stamping it out. The parasite itself was discovered by Dr. F. Katsurada, who worked out the activities of some of its five different stages from the egg to the adult. And there, to science, lies the great difficulty—that the thing has five

different animal forms, each of which seems equally deadly and to develop on a different host. The puzzle to be solved before the worm can be curbed is to find the host for each stage.

With the United States added to the list, the blood fluke disease seems now to have reached every country. It was a complete mystery until the German morphologist, Dr. A. Looss, working in Egypt from 1894 until 1909, studying cases of the Egyptian blood fluke, schistosoma haematobium, mastered that form of the disease. He also decided that the ancient skin trouble, bilharzia, was a by-product of the blood fluke trouble. Dr. R. Holcomb reported in the United States Naval Medical Bulletin ten cases of the disease in the West Indies due to the related worm, mansoni. Dr. F. G. Cawston found the disease prevalent in Natal. Dr. J. Turbe noted cases caused by the mansoni worm both in Venezuela and New Orleans. Dr. A. Lutz reported mansoni cases in Brazil in the Tropical District Bulletins.

The fluke, once lodged upon the skin of its host, or victim, at once brings into play an extraordinary battery of specially designated instruments to enable it to penetrate the skin and enter the blood stream. Besides a chevron-like fringe of spines at its forward tip, it carries a solvent agency and neutralizing fluid against the barring secretions of its host which rush to the point of entrance and strive to check the progress of the invader. These substances are contained in the cephalic glands and head glands of the worm. Dr. Cort notes that these cephalic glands function in penetration, probably by dissolving tissue; also, that instead of a single stylet or spike the worms have a number of spines around the cephalic glands, which perform the same function as the stylet in penetration. Besides dissolving the tissue of the skin, the secretion of the glands neutralizes the poisons or anti-toxins which the host produces in its attempt to check the invasion.

Examination fails to record either ameliorative treatment or remedies for the disease. Something in the matter with a man's liver. Naturally a doctor suggests

culty in finding an antidote or serum for the parasite lies in the fact that it is not a bacterium, but an actual animal. There has not yet been any evidence found that science can or ever will be able to make from animals a broth that, injected, will destroy the same kind of animals of which it was made. The matter of synthetic chemical treatment—such as salvarsan—is still in the land of vagueness. Further, there is no present means of diagnosing the blood fluke disease until an autopsy can be performed on the victim.

In the rice fields the parasite communicates itself to man by contact. It is spread in many ways. It finds lodgment upon a grain of rice, encysts itself, and unless the rice be thoroughly cooked, passes into a human host with food. It infects snails, slugs, rats and mice and other animals. These, carrying the tiny worms far afield, infect with them the water courses and in this way they may be borne to bathtubs, sinks and so on where they come in contact with human epidermis and find lodgment. They infect fish, and unless these be thoroughly cooked, the parasites find congenial surroundings in the fish eater. It is in this way that the disease is supposed to have been carried to Montana.

Although its natural habitat is water, or mud, the blood fluke is adaptable—as its use of a dry rice grain as vehicle shows. Dr. Cort received from Japan a set of infected snails. They were in dry dust when he received them. Yet the snails revived when placed in water and the worms with them.

Cercaria, the scientific name for one stage of the blood fluke, really means "tail of the beast," and was coined to describe the long tail shown in the diagram. Morphologists have so far been unable to distinguish the sexes in the blood fluke worm—although it has sex. The female deposits her eggs in the animal intestines. Leiper found four cases of eggs in man and three in dogs, fifty eggs all told. Dr. Cort tells what follows:

"Soon after the egg is placed in water the shell begins to swell by the activity of the miracidium—embryo—inside, often turning completely around. Finally, the egg bursts by splitting, allowing the miracidium to escape. It swims actively."

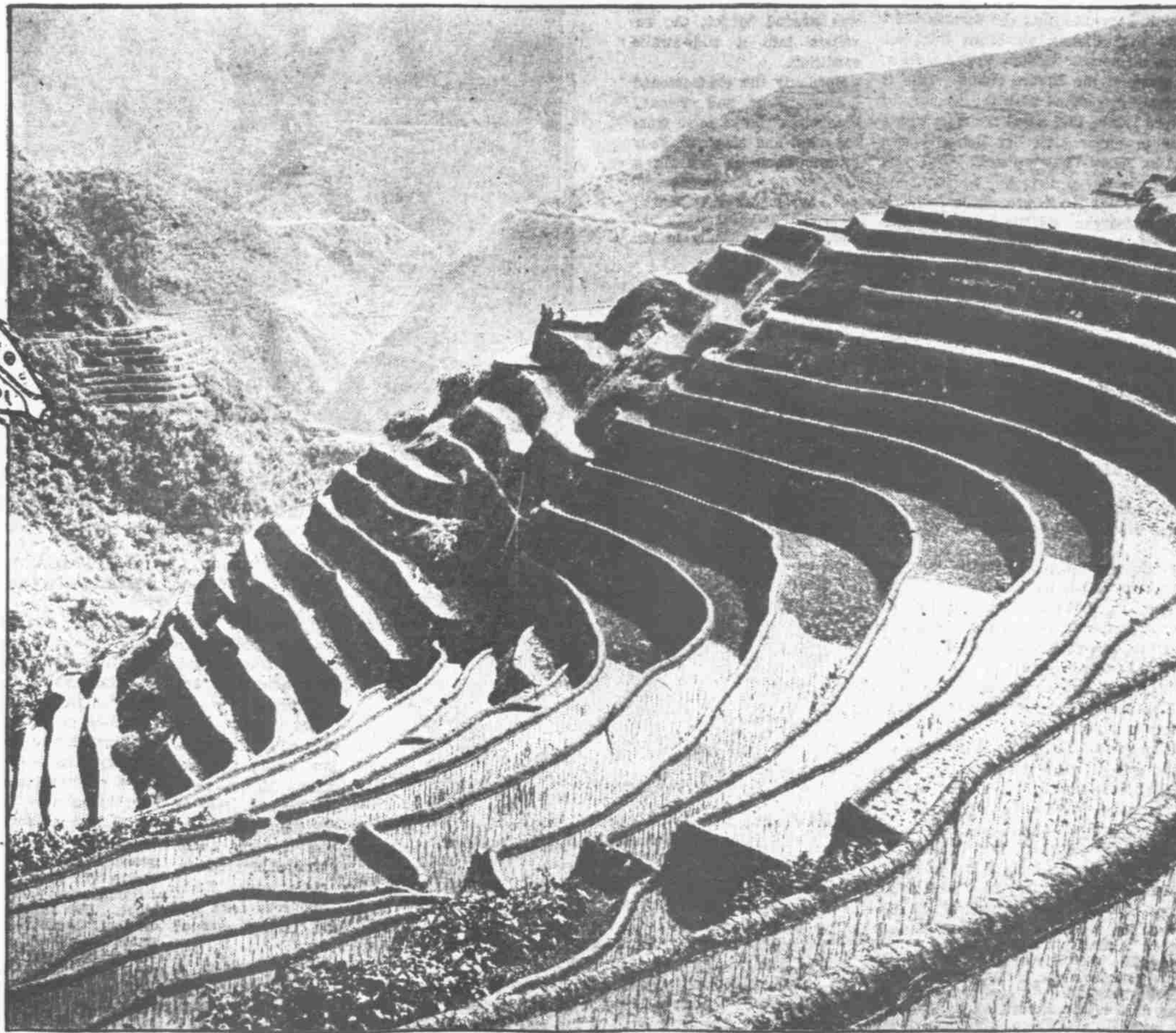
Miracidium really means "a little boy," applied in this case to mean a young, free-swimming liver fluke. The body is ciliated; that is, has hair-like appendages by which it moves about seeking for a host to encyst upon, just the same as an oyster spat must travel until it finds something solid to attach to, while growing up not only itself but a shell to live in safely. The miracidium has a sharp snout, or boring spine, by which, when it finds a mollusk, it excavates an entrance or works its way into the skin of an animal. The cercaria stage is now reached. When the minute animal finds a host it drops its tail and any other prolongations, and assumes a spherical shape. In this form of a little ball it becomes encysted, or coated, with a comparatively tough resisting layer.

One would think that the female distoma, having laid eggs which have hatched out larvae, adults could grow readily enough from the youngster. But no. Each young one must encyst on something and produce other forms by gemmation; that is, by budding, each bud becoming an independent being, usually at the expense of the life of the original mother. It looks very much as if the female did all of the work and that it costs her life. While she creeps out to lay her eggs the fortunate male can lead his own life of destruction of humans and other animals without bothering to move.

The fish morphologists have worked out the operations of these intestinal parasites to a far more definite and working conclusion than have the workers on mammalian parasitic worms. Dr. Edwin P. Linton, biologist of the Washington and Jefferson College, in his "Notes on the Fish Parasites of Marine Food Fishes," says:

"In Bermuda I found numerous round worms, nematodes, in the flesh of the garfish. They were crowded with ova and young, the latter very minute, very active and in vast numbers. What would be the result if eaten in insufficiently cooked fish? If, like the dread trichina, they can resist the digestive juices of the human stomach, they might easily penetrate the mucous membrane and, carried by the blood, finally lodge in congenial tissues of the body, to become encysted.

"Nematodes are very resistant to digestive fluids, and they are very near the popular conception of the word 'worm.' It is a well-known fact that many diseased conditions, and even epidemics, result from the presence of parasites, and, further, that the parasites, as a rule, are introduced either as eggs or larvae, along with the food."



Photograph of an Infected Oriental Rice Field in Which the Japanese Laborer Acquires the Parasite Producing the New Disease.

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The Dragon Nematode—Another Microscopic Cousin of the Blood Fluke That Preys Upon Man.

